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ABSTRACT

Ninety kindergarten, first-grade, and second-grade students participated in this study of ability to segment oral language into words and word units. Each child completed two individually administered oral segmentation tests and the Metropolitan Achievement Test. Results indicated that the ability to segment orally presented sentences developed earlier than the ability to segment the smallest sounds in words; the ability to segment complex sentences and words developed later than the ability to segment simpler, smaller units; and the ability to segment oral language developed at the same rate in boys and in girls. The ability to segment sentences had a significant and positive relationship to second-grade reading achievement, but the ability to segment words had no direct relationship to reading achievement at either first-grade or second-grade levels. (AA)

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Children's Ability to Segment Oral Language

Are we perpetuating a myth by believing that beginning readers are able to analyze oral language and apply their knowledge to the written message? Do beginning readers, children of six or seven, know that when they speak they generate sentences, and that sentences are composed of words, and that words are composed of sounds? Part of the reason that learning to read may be so difficult is that children may not be competent enough to attend to the meaning of a spoken message and to segment the speech flow into the smallest of its component parts.

Most methods of reading require, at one time or another and with greater or lesser emphasis, the teaching of auditory analysis skills as an aid to word recognition. Gray (1969) indicated this was so on the international level, as did Venezky (1972) on the national level. In a book about teaching reading as a language experience, Hall (1970) recommended that letter sounds in both spoken and written words be taught and mastered. Beginning readers, then, are expected to perform auditory analysis. It seems pertinent therefore to ask whether or not children can segment oral language before they are asked to apply these skills to printed language.

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A review of previous studies showed that children below the age of seven could not accurately segment phrases or sentences into discrete words (Karpova, 1955; Holden and MacGinitie, 1972; Huttenlocker, 1964). In word segmentation studies it was found that kindergarten and first grade children found syllables easier to segment than phonemes (Liberman and others, 1973), that initial sound units were easiest to isolate and manipulate (Bruce, 1964; Dettsova, 1953; Zhurova, 1963), and that children had difficulty sequentially segmenting phonemes from words (Skjelfjord, 1976). In all of the above mentioned studies, the youngest children had the most difficulty with segmentation.

A review of the correlational studies showed that when auditory analysis tasks were measured by standardized tests, the correlations with reading performance ranged from .18 to .43 (Dykstra, 1966). When auditory analysis tasks were measured by oral responses and/or manipulative tasks, the correlations with reading performance ranged from .47 to .84, with the highest correlation appearing in the third grade (Calfee, Lindamood, and Lindamood, 1973; Chall, Roswell, and Blumenthal, 1963).

Purpose of the Study

A cross-sectional study was undertaken to discover if there is a developmental pattern in children's ability to segment oral language into words and word units; to determine

if oral language segmentation ability develops in a sequential and hierarchal order; to determine if there is a correlation between children's ability to segment oral language and their ability to read; and to devise a guideline for teaching children auditory analysis skills based on the findings.

Subjects

There were ninety subjects in this study. They were equally distributed in kindergarten, first, and second grades. Fifteen boys (eight White and seven Black) and fifteen girls (eight White and seven Black) were selected from the district's total population by race and by grade by a modified randomization. Children with severe hearing losses, children who had been retained, and bilingual children were excluded from the study. The subjects lived in a small, integrated Long Island community. The socio-economic status of the residents of the community ranged from lower to middle class. Of the approximately 4,200 students in the district, 20 percent received public assistance.

Instruments

Three instruments were used in the study, two individually administered oral segmentation tests, and the Metropolitan Achievement Test (MAT), Reading Battery. All testing was done in April and May of 1977.

The sentence segmentation test was designed to examine

children's ability to segment words from orally presented sentences. It was composed of eighteen sentences varying in length from one to nine words. The sentences were arranged in blocks. The first block contained two sentences each of one, two, and three words. The second block contained two sentences each of four, five, and six words; and the third block contained two sentences each of seven, eight, and nine words. The order of sentences in each block was randomized. Each child received all eighteen sentences. The children were asked to listen to each sentence and repeat it as they moved beads on a counting frame. The examiner was allowed to repeat the sentence three times. After the test, the children were shown cards with the sentences on them. The cards were read to the children, and they were asked to count the words in each sentence.

The word segmentation test was designed to examine children's ability to segment orally presented words into units of sound. It was composed of eighteen words, varying in length from one to nine phonemes. The words were arranged in three blocks. The first block contained two words each of one, two, and three phonemes. The second block contained two words each of four, five, and six phonemes; and the third block contained two words each of seven, eight, and nine phonemes. The order of words was randomized within each block, and the children received all eighteen words. The children were asked to listen to a word. repeat it, and tell

which sounds they heard. If children repeated sentences or words in their dialect, and segmented them in dialect, they were given equal credit. Each correctly segmented word on the sentence test received a score of 1, and each correctly segmented unit of sound on the word test received a score of 1.

In order to eliminate a teaching-testing situation, no sample demonstration items were included in either test, and the word segmentation test was administered after the sentence test. The split-half reliability coefficients obtained for each of the segmentation tests were .98.

Hypotheses

The hypotheses formulated for the study were:

1. There will be a significant difference among the kindergarten, first, and second grade groups in their ability to segment sentences into words.

2. There will be a significant difference among the kindergarten, first, and second grade groups in their ability to segment words into units of sound.

3. At each of the grade levels there will be a significant difference between boys and girls in their ability to segment sentences into words.

4. At each of the grade levels there will be a significant difference between boys and girls in their ability to segment words into units of sound.

5. There will be significant, positive correlations among first graders' scores on sentence segmentation and their scores on word segmentation, the MAT word knowledge, word analysis, and reading subtests, and their total reading score.

6. There will be significant, positive correlations among second graders' scores on sentence segmentation and their scores on word segmentation, the MAT word knowledge, word analysis, and reading subtests, and their total reading score.

Exploratory Questions

The exploratory questions were:

A. Was there a difference between children's ability to segment sentences into words as compared to their ability to segment words?

B. Into which units did the children segment sentences?

C. Into which sound units did children segment words?

D. Was there a difference between children's ability to orally segment sentences and their ability to visually identify words in sentences?

E. Was there a developmental pattern evident in the children's responses on the sentence and word tests?

Analysis of the Data

A 2x3 analysis of variance (ANOVA) was used to test

the differences among kindergarten, first, and second grade groups in their ability to segment words into units of sound. It was also used to test the differences, at each grade level, between boys and girls in their ability to segment words into units of sound.

A Kruskal-Wallis ANOVA was used to test the differences among kindergarten, first, and second graders in their ability to segment sentences into words.

The Mann-Whitney U test was used to test the differences, at each grade level, between boys and girls in their ability to segment sentences into words. (The Kruskal-Wallis and Mann-Whitney U tests are non-parametric. Non-parametric tests were used because the sentence test did not yield a normal curve.)

The Pearson product-moment correlation was used to determine correlations among first and second graders' scores on the segmentation tests, the MAT subtests, and the MAT total reading scores. The significance level for all statistical procedures was set at .01; and raw scores were used for all the calculations.

In addition, after the standardized test scores were obtained, the ten children with the highest total reading scores (good readers) and the ten with the lowest total reading scores (poor readers) were identified at the first and second grade levels. Their test protocols were compared to determine if there was any difference in segmentation

patterns between good and poor readers. Finally, a guideline for teaching auditory analysis skills based on the findings was devised.

Findings for the Hypotheses

1. In sentence segmentation, as seen in Table 1, the obtained H for the Kruskal-Wallis ANOVA was significant beyond the .01 level. The rank sum for first grade was almost 300 times larger than the rank sum for kindergarten, while the second grade rank sum was 23 percent larger than the first grade rank sum. Hypothesis 1 was accepted. There was a significant difference among kindergarten, first, and second grade children in their ability to segment sentences into words.

Table 1

Kruskal-Wallis ANOVA--Sentence Test
N=90

Group	Frequency	Rank Sum	H
K	30	542	
1	30	1,591	53.07*
2	30	1,962	

*Significant beyond .01

2. In word segmentation, as seen in Table 2, the 2x3 ANOVA F ratio for main effect B (grade) was significant beyond the .01 level. A Tukey (a) follow-up test was used to test the differences between pairs of grade level means on the word test. There were significant differences between the kindergarten and first grade means and between the kindergarten and second grade means. (See Table 3.) Hypothesis 2 was accepted. There were significant differences between the kindergarten and first grade groups, and between the kindergarten and second grade groups in their ability to segment words into units of sound. There was no significant difference between first and second grade groups.

Table 2

2x3 ANOVA--Word Test
N=90

Source	SS	df	Mean^2	F	Significance Level
A (sex)	3.63	1	3.63	.03	.87
B (grade)	25,984.81	2	12,992.41	102.40	.001
AB	68.00	2	34.00	.27	.76
Residual	10,658.14	84	126.88		
Total	36,714.57	89			

Table 3

Mean Scores and Standard Deviations for the Word and Sentence Segmentation Tests
N=90

Grade		Word Test			Sentence Test		
		Boys n=15	Girls n=15	Total n=30	Boys n=15	Girls n=15	Total n=30
Kindergarten	Mean	12.9	12.6	12.7	40.[illegible]	44.2	42.5
	S.D.	11.1	14.6	12.7	29.1	27.5	27.9
First	Mean	46.1	48.6	47.5	79.1	80.2	79.7
	S.D.	10.0	9.6	9.6	12.0	7.7	9.9
Second	Mean	50.6	49.3	49.9	84.8	84.6	84.7
	S.D.	13.1	7.7	10.6	3.9	4.9	4.4

3. The differences between boys and girls in sentence segmentation ability was tested by the Mann-Whitney U test. Table 4 shows that the obtained U for each of the grade levels was not significant. Hypothesis 3 was rejected. At each of the grade levels, there was no significant difference between boys and girls in their ability to segment sentences into words.

Table 4

Mann-Whitney U--Sentence Test
N=90

	Kindergarten n=30	First Grade n=30	Second Grade n=30
Rank Sum--Boys	228	234.5	229.5
Rank Sum--Girls	237	230.5	235.5
U	108	114	109
Significance	n.s.	n.s.	n.s.

4. The differences between boys and girls in word segmentation ability was tested by the 2x3 ANOVA (Table 1). There were no significant interactions between sex and grade. As can be seen in Table 3, the difference in means between boys and girls at each grade level were slight. Hypothesis 4 was rejected. At each of the grade levels there was no significant difference between boys and girls in their ability to segment words into units of sound.

5. As shown in Table 5, at the first grade level the word segmentation test was correlated to the sentence segmentation test at .42, which was significant at the .01 level. All other correlations were non-significant. Hypothesis 5 was rejected. There were no significant, positive correlations among the segmentation tests and the MAT subtests and total reading scores.

Table 5

Correlations Between the Scores of the Segmentation Tests and the Reading Achievement Test

		Word Test	Sent. Test	Word Know.	Word Analysis	Reading	Total Reading
First Grade	Word Test		.42*	.07	.25	.13	.12
	Sent. Test			-.11	.06	.26	.09
Second Grade	Word Test		.07	.001	-.001	-.03	-.003
	Sent. Test			.42*	41*	.45*	.42*

*Significant at .01

6. As shown in Table 5, at the second grade level the sentence test was significantly correlated with all of the MAT scores. The correlations for the sentence test were: MAT word knowledge, .42; MAT word analysis, .40; MAT reading, .45; and MAT total reading, .42. Hypothesis 6 was partially accepted. There were significant positive correlations between the sentence segmentation test scores and each of the reading achievement test scores.

Other Findings

1. In comparing children's ability to segment sentences and words, it was necessary to examine the total group's performance on both tests. For both tests the lowest possible score was 0 and the highest possible score was 90. On the sentence test the children's scores ranged from 0 to 90, the mean was 68.9, and the standard deviation was 25.5. Of the total group, 5.5 percent (five children--all second graders) achieved a score of 90. On the word test the range of scores was 0 to 83, the mean was 42.8, and the standard deviation was 20.3. The highest score was 83, and only 1.1 percent of the group (one child--a second grader) achieved it. The answer to Exploratory Question A was affirmative. There was a difference in children's ability to segment orally presented sentences as compared to their ability to segment orally presented words. The ability to segment sentences appeared to develop earlier and with more accuracy than the ability to segment words.

2. An examination of the children's responses on the sentence test showed that at each grade level children segmented sentences into words, syllables, and combined word units. The combined word units were composed of articles, adjectives, pronouns, conjunctions, adverbs, prepositions, or infinitives attached to preceding or following adjacent words. As Table 6 shows, the younger children made more sentence segmentation errors, and the greater number of

Table 6

Sentence Test Error Analysis for Kindergarten, First, and Second Grades

Grade	Number of Word Splitting Errors	Number of Word Combining Errors	Average Number of Words Incorrectly Segmented	Percentage Making No Errors Block 1	Percentage Making No Errors Block 2	Percentage Making No Errors Block 3
Kindergarten	111	316	44.5	20 %	0 %	0 %
First	119	59	10.3	66.7%	36.7%	0 %
Second	64	39	5.3	90 %	60 %	16.7%

their errors fell into the word combining category. The older children made fewer errors, and the greater number of their errors fell into the word splitting category. (Words were divided into syllables, and the syllables were counted as words.) Word combining errors were considered to be over-general responses, while word splitting errors were considered to be over-specific responses. Exploratory Question B asked: Into which units did kindergarten, first, and second grade children segment sentences? At each grade level, the children segmented sentences into words, syllables and combined word units.

3. The word test protocols were examined by grade and by block to determine into which sound units children segmented words. The responses fell into four categories: phonemes, blends, phonograms (vowel-consonant combinations), and syllables. Table 7 contains a summary of the word segmentation data. Of the kindergarten children who were able to segment sounds, the majority segmented only one sound from a word--a phoneme, blend, or syllable. Those who were able to make two segmentations segmented three phoneme words into either initial or final phonemes or into a phoneme and a phonogram. Longer words were segmented into phonemes and phonograms or syllables. No kindergartener segmented each of the three phoneme words into each phoneme. The range of scores was 0 to 43, and the average number of sounds segmented was 12.8.

Table 7

Patterns of Word Segmentation Responses
Reported by Grade and by Block

	Kindergarten n=30			First Grade n=30			Second Grade n=30		
	Block 1	Block 2	Block 3	Block 1	Block 2	Block 3	Block 1	Block 2	Block 3
Maximum Number of Segmentations Possible	3	6	9	3	6	9	3	6	9
Maximum Number of Segmentations Made	2	3	5	3	6	7	3	6	9
Percentage Making Maximum Number of Segmentations	13.3%	10 %	3.3%	46.6%	6.7%	3.3%	36.7%	10 %	3.3%
Percentage Segmenting Both of the Longest Words in the Block	0 %	0 %	0 %	13.3%	0 %	0 %	16.7%	0 %	0 %
Percentage Segmenting Only Phonemes from Words	33.3%	13.3%	13.3%	70 %	30 %	20 %	66.7%	20 %	3.3%
Percentage Segmenting Phonemes and Phonograms or Syllables from Words	16.7%	56.7%	70 %	26.7%	70 %	80 %	33.3%	80 %	96.7%

Most kindergarteners used the following strategies to segment words. The children repeated the word once, sat silently, then: repeated the word again elongating the beginning sound, and then isolated the sound (i.e., shhhhadow, shhh); or isolated and repeated a syllable, and then repeated the word (i.e., plent-plent, plenty).

In the first block (words of one to three phonemes), 13.3 percent of the first graders segmented each of the three phonemes into each phoneme; 70 percent segmented only phonemes from words, and 30 percent segmented a combination of phonemes and phonograms. In the second block (words of four to six phonemes), 6.7 percent of first graders segmented each of the six phoneme words into each phoneme; 30 percent segmented only phonemes from words; and 70 percent segmented phonemes and phonograms or syllables from words. In the third block (words of seven to nine phonemes), 20 percent of the first graders segmented only phonemes from words, while 80 percent segmented words into phonemes and phonograms or syllables. At the first grade level the word test scores ranged from 31 to 72 and the average number of segmentations made was 47.3.

In the first block, 36.7 percent of the second graders segmented each of the three phoneme words into each phoneme; 66.7 percent segmented only phonemes from words; and 33.3 percent segmented three phonemes into phonemes and phonograms. In the second block, 10 percent of the children

segmented each of the six phoneme words into each phoneme; 20 percent segmented only phonemes from words, while 80 percent segmented words into phonemes and each of phonograms or syllables. In the third block, 3.3 percent segmented the nine phonemes into each phoneme; 3.3 percent segmented only phonemes from words; and 96.3 percent segmented words into phonemes and phonograms or syllables. At the second grade level the range of scores for the word test was 35 to 83, and the average number of sounds segmented was 50.

In addition, although first and second graders made almost the same number of segmentations, the first graders lost more sound information than did second graders. For example, for the word "broken" a first grader might segment br, o, k. A second grader tended to make the same number of segmentations, but they were often in chunks which encompassed all the sounds (br, o, ken).

Exploratory Question C asked: Into which units did children in kindergarten, first, and second grade segment words? At each grade level, children segmented words into phonemes, blends, phonograms, and syllables. When words were composed of four or more phonemes, all of the children preferred to segment them into units larger than phonemes.

4. An analysis of the children's scores in visual segmentation of sentences revealed that 30 percent of kindergarteners, 90 percent of first graders, and 100 percent of the second graders visually segmented all sentences

correctly. In comparison, when asked to segment orally presented sentences, neither the kindergarteners nor the first graders could segment each of the orally presented sentences accurately. However, 16.7 percent of the second graders could do so.

Exploratory Question D asked: Was there a difference between children's ability to orally segment sentences and their ability to visually identify words in sentences. The answer was affirmative. Children appeared to develop the ability to identify word boundaries in print sooner than they developed the ability to segment words in orally presented sentences.

5. Exploratory Question E asked: Was there a developmental pattern evident in children's responses on the sentence and word segmentation tests? Developmental patterns were evident in both segmentation tasks. Tables 4 and 6 show that older children segmented more words from sentences, and more words from longer, harder sentences than did younger children. (This was probably not due to memory problems as the examiner was allowed to repeat the sentences three times, and the children did not have to store and count words. They moved beads or their fingers as they segmented the sentences.) In addition, more of the errors of older children were classified as over-specific rather than over-general.

In word segmentation, as seen in Tables 4 and 7, older

children segmented more sounds from words than did younger children. Older children were also able to segment some of the longest words into their smallest units, whereas the younger children could not. Finally, the older children's segmentation strategies were more thorough and effective than those of the younger children.

6. At both the first and second grade levels the segmentation responses of ten good and ten poor readers were examined. Table 8 contains a summary of the segmentation comparisons, while Table 9 contains a comparison of mean scores. In sentence segmentation, at both grade levels, poor readers appeared more inconsistent in determining word boundaries. More poor readers made both word splitting and word combining errors than did good readers. In word segmentation, a slightly larger percentage of poor readers segmented longer words into phonemes than did good readers. In addition, at both grade levels, good readers were mainly girls, while poor readers were mainly boys.

The lack of clear trends between good and poor readers appeared to be consistent with previous findings which showed that there were no significant differences between boys and girls in segmentation ability and that there were no significant correlations between word segmentation scores and reading achievement scores at the first and second grade levels.

Table 8

Comparison of Segmentation Patterns of Good and Poor Readers in First and Second Grades Reported in Percentages of Group Scores

	Good Readers		Poor Readers	
	First Grade n=10	Second Grade n=10	First Grade n=10	Second Grade n=10
Percentage of Boys	20	30	90	70
Percentage of Girls	80	70	10	30
Segmentation Patterns Sentence Test				
Word Splitting Errors Only	50	30	20	30
Word Combining Errors Only	0	10	10	0
Both Types of Errors	50	20	70	70
No Errors	0	40	0	0
Word Test--Block 1				
Phonemes	70	30	70	40
Phonemes and Phonograms	30	70	30	60
Word Test--Block 2				
Phonemes	20	20	30	30
Syllables	10	20	10	0
Phonemes and Phonograms or Syllables	70	60	60	70
Word Test--Block 3				
Phonemes	30	20	30	20
Syllables	0	40	0	30
Phonemes and Phonograms or Syllables	70	30	70	40

Table 9

Comparison of Mean Scores and Standard Deviations of Good and Poor Readers in First and Second Grades

		First Grade		Second Grade	
		Good Readers n=10	Poor Readers n=10	Good Readers n=10	Poor Readers n=10
MAT Total Reading	Mean	74.2	45.6	80.0	40.6
	S.D.	2.0	4.6	1.2	8.5
Sentence Test	Mean	80.4	77.1	87.2	82.6
	S.D.	8.9	14.0	4.3	3.3
Word Test	Mean	48.2	43.7	51.9	51.3
	S.D.	11.8	6.5	14.0	7.3

Conclusions

The children in this study appeared to develop oral segmentation skills in a developmental pattern; the ability to accurately segment orally presented sentences developed earlier than the ability to segment the smallest sounds in words. The ability to segment complex sentences and words developed later than the ability to segment simpler, smaller units. In addition, the ability to segment oral language developed at the same rate in boys and girls.

The ability to segment orally presented sentences had a significant and positive relationship to reading achievement at the second grade level. The ability to segment orally presented words may provide a foundation upon which children can learn to decode. However, at both first and second grade levels, it appeared to have no direct relationship to reading achievement as measured by standardized reading tests.

Guideline for Teaching Auditory Analysis Skills

The evidence suggested that oral language segmentation ability develops in a sequential order over time, and in a hierarchal order of complexity.

Sequence of Skills

The findings showed that children were able to visually identify word boundaries in sentences sooner and with more accuracy than they were able to segment orally presented

sentences, and that the ability to segment orally presented sentences into words developed earlier and with more accuracy than the ability to segment orally presented words into units of sound. Therefore, the recommended sequence for teaching segmentation skills is: segmentation of visually presented sentences, segmentation of orally presented sentences, and segmentation of orally presented words.

Order of Complexity

It is suggested that within the sequence outlined above, the simpler skills be taught before the more complex skills.

The children in this study were able to segment shorter sentences into words with more accuracy than longer sentences. They also had difficulty determining word boundaries of multi-syllabic words. It is therefore recommended that children be taught to segment sentences in the following order: (1) declarative sentences composed of one syllable words; (2) imperative sentences composed of one syllable words; (3) declarative sentences with some two syllable words; and (4) complex sentences with word length uncontrolled.

In word segmentation, the findings indicated: (1) younger children made fewer sound segmentations than did older children; (2) younger children often made one segmentation per word with the segmented sound being either

a phoneme, blend or syllable; (3) younger children made a maximum of two segmentations for three phoneme words; and (4) children prefer to segment longer words into units larger than phonemes. Based on these findings, it is recommended that children be taught to segment orally presented words into sounds in the following order: (1) initial phonemes segmented from three phoneme words; (2) initial blends segmented from one syllable words; (3) multi-syllabic words segmented into syllables; (4) three phoneme words segmented into initial phoneme and phonogram; (5) one syllable words segmented into initial blend and phonogram; and (6) multi-syllabic words segmented into phonemes and phonograms or syllables.

It is further recommended that children acquire skills in analyzing orally presented words before they are asked to analyze printed words so that they will have an oral language referent for decoding.

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